GHRSST-PP Data Product Specifications v2.0

GHRSST-PP Reference Document GHRSST/10

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Prepared by the GHRSST-PP Science Team

Executive Summary

This document provides a summary of GHRSST-PP data products that will be produced during the GHRSST-PP demonstration phase in 2003-2005. Initial data product specifications were derived from discussions at the Second GHRSST-PP workshop held at the Earth Observation Resource Centre, Tokyo, Japan in May 2002 which is fully reported in GHRSST-PP reference document GHRSST/5 (available from the GHRSST-PP web site at http://www.ghrsst-pp.org.).

During May-September 2002, the version 1.0 GHRSST-PP data products specifications were thoroughly reviewed by the GHRSST-PP In situ and Satellite data Integration Technical Working Group (ISDI-TAG). This group was tasked to consider the scientific and operational aspects of GHRSST-PP merged and analysed data products. The following pages describe the revised GHRSST-PP version 2.0 Data Product Specifications that incorporate all of the recommendations of the ISDI-TAG review.

Document change record

Author	Modification	Issue	Rev.	Date
C J Donlon	Original	GHRSST/10 1.0	0.4	June 20 2002
C J Donlon	ISDI-TAG recommendations included	GHRSST/10 2.0	1	Oct 8 2002

1 Introduction

This document is for groups or individuals who use satellite derived sea surface temperature (SST) data sets and especially those interested in their real time application. It provides a summary of the global SST data products that will be produced, in real time and in a delayed reanalysis mode, by the Global Data Assimilation Experiment (GODAE) high-resolution sea surface temperature pilot project (GHRSST-PP).

The GHRSST-PP has been established to provide international focus and coordination for the development of a new generation of global, multi-sensor, high-resolution (better than 10 km), sea surface temperature (SST) products provided in real time (6 hourly). It provides a major contribution to the GODAE Common (Bell et al., 2002) as a measurement network as described in the GODAE implementation plan (Smith et al., 2002). Its primary aim is to oversee the development, timely delivery, assembly and processing high-quality, global scale, SST products at a fine spatial and temporal resolution, for the diverse needs of GODAE and the wider scientific community. Against this background, the broader objective of the GHRSST-PP is to provide focus and coordination for the sustained development and application of a new generation of global, high-resolution, SST products.

The coordination and implementation preparations for the GHRSST-PP commenced at the first GHRSST-PP workshop held in November 2000. The GHRSST-PP ***preparation phase*** is mainly concerned with engaging and consolidating the GHRSST-PP community and implementation of the basic GHRSST-PP. It will run until July 2003 cumulating in an operational demonstration of "version 1.0" GHRSST-PP products and services.

The preparation phase will be superseded by the GHRSST-PP ***demonstration phase*** that will continue until the end of 2005. During the demonstration phase, GHRSST-PP data products and services will be continually refined and made available, in real time, to the broad GHRSST-PP user community. Throughout the demonstration phase, a parallel and continual process of project development and refinement is foreseen with particular emphasis on the improvement of demonstration data products and delivery to operational users.

During 2004-2005, data products will be provided to a number of specific operational users who will work closely with the GHRSST-PP Science Team to evaluate the products using a variety of specific applications demanding real time high-resolution SST data products. Dedicated model runs, inter-comparison exercises and assimilation experiments will all take place in real time. This period is called the GHRSST-PP ***intensive application phase***.

2 GHRSST-PP Data Product Specifications

During the 2nd GHRSST-PP Workshop "Removing the Barriers to the implementation of the GHRSST-PP", Tokyo, May 2002, (see GHRSST-PP reference document GHRSST/5 for a full workshop proceedings) the GHRSST-PP Science Team (ST) agreed on the specification of the project data products.

2.1 Data product families

Three types of GHRSST-PP SST demonstration product families will be produced: merged products, analyzed products and reanalysis products.

Merged products consist of L2a collated separate satellite data streams that have been calibrated cleared of cloud re-gridded to a common grid format. Each data set will be produced at the highest spatial and temporal resolution possible and will have variable spatial and temporal resolution. No interpolation or combined analysis will be performed. Merged data products retain all of the error statistics derived from error coding schemes based on in situ data sets for each pixel in each input data set. These products are volatile, changing as new data arrives in real time but will be consolidated and archived at 6 hourly intervals corresponding to the synoptic Meteorological forecast times. Due to high data volumes and time constraints, only a moderate level of quality control may be possible. These products are expected to serve the ocean modeling community.

In contrast, ***analysed products*** are derived from the combined analysis of all merged products produced at 12 hourly intervals corresponding to the synoptic Meteorological forecast times. Analyzed data products have a single output grid together with confidence data including a diurnal signal mask, sea ice mask and a set of confidence flags. Error statistics consist of a mean bias and rms. estimate for each grid point derived from a combination of errors due to the analysis methodology and error coding schemes based on in situ data sets for each pixel in each input data set. A high level of quality control is expected. Analyzed data are permanent data that are initially archived but will be reanalyzed within 7 days of archive as a final delayed mode data set. These products are expected to serve the NWP and ocean modeling community.

Finally, ***reanalysis products*** are derived in a delayed mode 7-60 days after data reception to take advantage of additional data sources unavailable in real time, particularly in situ observations and satellite data sets. The highest level of quality control will be performed on these data that will be produced at 12 hourly intervals. Analyzed products are expected to serve the climate and general user community.

2.2 Data product family members

SST is a difficult parameter to define exactly because the upper ocean (~10 m) has a complex and variable vertical temperature structure that is related to ocean turbulence and the air-sea fluxes of heat, moisture and momentum. Definitions of SST provide a necessary theoretical framework that can be used to understand the information content and relationships between measurements of SST made by different instruments. Figure 1 provides a schematic diagram that provides this framework and encapsulate the effects of the dominant heat transport processes and time scale of variability associated with distinct vertical and volume regimes within a vertical element of the water column (horizontal and temporal variability is implicitly assumed).

- The interface SST, SSTint, is the temperature of an infinitely thin layer at the exact air-sea interface. It represents the temperature at the top of the SSTskin temperature gradient (layer) and cannot be measured using current technology. It is important to note that it is the SSTint that interacts with the atmosphere.

- The skin SST, SSTskin, is a temperature measured within a thin water layer (<500 micrometer) adjacent to the air-sea interface. It is where conductive, diffusive and molecular heat transfer processes dominate. A strong vertical temperature gradient is characteristically maintained in this thin layer sustained by the magnitude and direction of the ocean-atmosphere heat flux. Thus, SSTskin varies according to the actual measurement depth within the layer. This layer provides the connectivity between a turbulent ocean and a turbulent atmosphere.

- The sub-skin SST, SSTsub-skin, is representative of the SST at the bottom of the surface layer where the dominance of molecular and conductive processes gives way to turbulent heat transfer. It varies on a time scale of minutes and is influenced by solar warming in a manner strongly dependent on the turbulent energy density in the layer below.

- The near surface ocean temperature (~10 m) is significantly influenced by local solar heating and typically varies with depth over a time scale of hours. Consequently "SST" measurements should always be referenced against a specific depth or an average over a depth range. We use the notation SSTdepth to refer to any temperature within the water column beneath the SSTsub-skin where turbulent heat transfer processes dominate. Note that at the same depth, SSTdepth may be significantly different depending on the time

of day and degree of thermal stratification. The traditional "bulk" SST is related to this measure. SSTdepth should always be quoted at a specific depth in the water column (e.g., SST1m refers to the SST at a depth of 1m) and ideally, the local time of day.

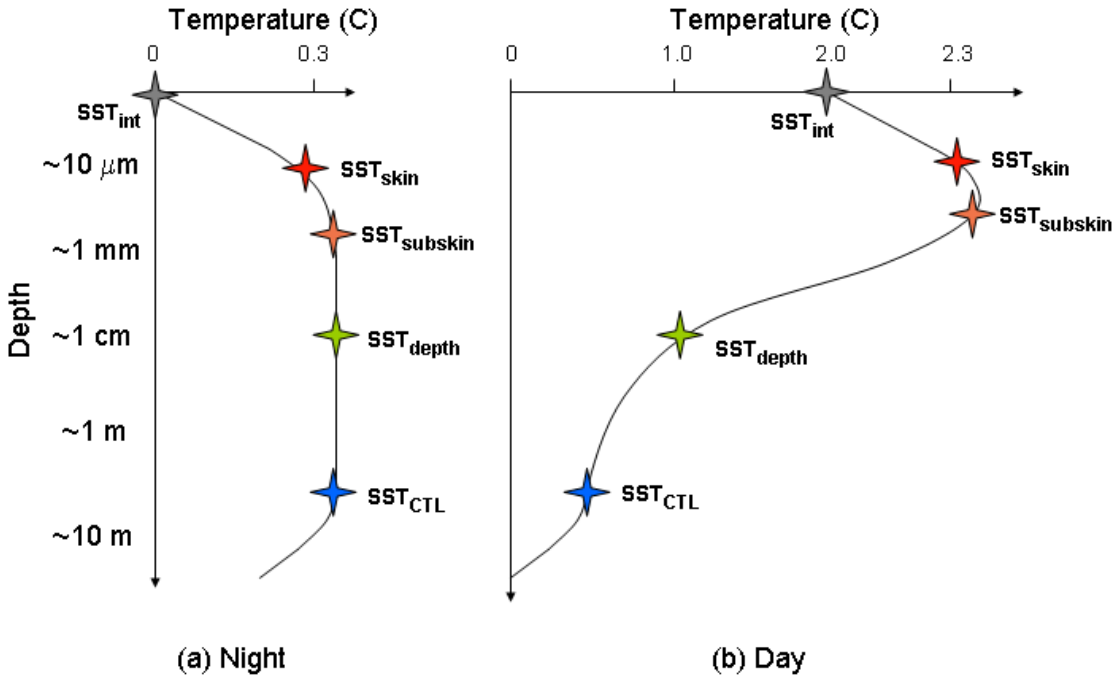

Figure 1. A schematic diagram showing a vertical temperature profile through the ocean surface layer during (a) night time and (b) day time with solar heating.

- SSTctl provides a connection to SSTdepth measurements focused on providing a measurement representative of the oceanic mixed layer temperature. The product gives the temperature at a "constant temperature layer" where there are no significant variations (>0.2K) due to diurnal warming. This may also be considered the temperature at the base of the diurnal layer. Following this definition, the effective depth of the product can vary significantly depending on the conditions and the strength of the diurnal cycle. It is important to consider this product in relationship to an SSTdepth temperature measurement at fixed depth with any diurnal temperature variations removed. Consequently, a nominal depth value for SSTctl should be provided with each measurement. In general, SSTctl will be similar to a night-time minimum SST or pre-dawn SST value at depths of 1-2 m, but some differences could exist. The definition adopted here was selected to provide a more precise, well-defined quantity. SSTctl will

likely provide a better representation of the mixed layer temperature than previous loosely defined "bulk" temperature quantities.

2.3 Version 2.0 GHRSST-PP Data product Specifications

The GHRSST-PP data product specifications (v2.0) including all of the ISDI-TAG recommendations for merged and analysed data products are presented in Table 1.

Table 1. GHRSST-PP data product specifications (v2.0) following review by the ISDI-TAG.

Characteristic	Merged SST	Analyzed SST	Reanalyzed SST
Grid Size	10 km with specific local area products at 2km	10 km with specific local area products at 2km	10 km with Specific local area products at 2km
Temporal resolution	6 hours (00:00, 06:00, 12:00,18:00 UTC)	12 hours (00:00 and 12:00 UTC) produced as a daily product with associated diurnal products.	12 hours (00:00 and 12:00 UTC) produced as a daily product with associated diurnal products.
Delivery timescale	Real time	Real time	7-60 days following data reception and reanalysis
Accuracy	< 0.5 K absolute 0.1 K relative	< 0.5 K absolute) 0.1 K relative	< 0.3 K absolute (target), 0.1 K relative
Error statistics	rms. and bias for each input data stream at every grid point	rms. and bias for each output grid point (no input data statistics are retained)	rms. and bias for each output grid point (no input data statistics are retained)
Coverage	Regional (Best effort Global)	Global, (Regional extracted)	Global
SSTskin product	one value per sensor, per grid point, per time interval retained	Yes	Yes
SSTsub-skin product	one value per sensor, per grid point, per time interval retained	Yes	Yes
SSTctl product	one value per sensor, per grid point, per time interval retained	Yes	Yes
Cloud mask	One value for SSTskin, SSTsubskin and SSTctl	Yes	Yes
Diurnal product content	Peak warming magnitude and time of peak warming (SSTskin, SSTsubskin) with derivation indicator flags	Peak warming magnitude and time of peak warming (SSTskin, SSTsubskin) with derivation indicator flags	Peak warming magnitude and time of peak warming (SSTskin, SSTsubskin) with derivation indicator flags
Confidence Statistics product content	Grid cell bias and standard deviation, data aquisition information, SSTctl depth, pixel level data including number of retrievals contributing to the grid value, time of observations, sensor types contributing to the analysis, and cloud type detected	Grid cell bias and standard deviation, SSTctl depth, quality flags	Grid cell bias and standard deviation, SSTctl depth, quality flags
Nominal product format	Hdf/BUFR/NetCDF	Hdf/BUFR/NetCDF	Hdf/BUFR/NetCDF

3 References

The following reference documents can be obtained from the GHRSST-PP web site located at http://www.ghrsst-pp.org.

GHRSST/5: Report of the 2nd GHRSST-PP workshop, Tokyo, Japan (May 14-16th 2002).
GHRSST/12: GHRSST-PP ISDI-TAG Terms of Reference and Membership.
GHRSST/13: The First Report of the GHRSST-PP In situ and Satellite Data Integration-Technical Advisory Group (ISDI-TAG).

4 GHRSST-PP contacts

For further information on the GHRSST-PP, SST data and applications please contact:

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